

Citation:

Newby PK, Tucker KL, Wolk A. Risk of overweight and obesity among semi vegetarian, lactovegetarian and vegan women. *Am J Clin Nutr*. 2005 Jun; 81 (6): 1,267-1,274.

PubMed ID: [15941875](#)

Study Design:

Cross-Sectional Study

Class:

D - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine body mass index (BMI) and risk of overweight and obesity among self-defined semi-vegetarian, lacto-vegetarian and vegan women.

Inclusion Criteria:

Participants in the first wave of the Swedish Mammography Cohort (1987-1990), which included women born between 1914 and 1948 living in Vastmanland and Uppsala counties in central Sweden.

Exclusion Criteria:

Women:

- With cardiovascular condition of angina, diabetes, coronary disease, or stroke
- With a previous diagnosis of cancer
- With questionnaires with missing important variables or with implausible variables
- Who moved out of the study area
- Who died during the study period, but were missing a date of death.

Description of Study Protocol:**Recruitment**

All women born between 1914 and 1948 living in Vastmoreland and Uppsala counties in central Sweden were invited to a population-based mammography screening program.

Design

Cross-sectional study.

Dietary Intake/Dietary Assessment Methodology

Dietary intakes were assessed with a food-frequency questionnaire (FFQ), and were asked whether they considered themselves to be omnivorous, semi-vegetarian, lacto-vegetarian or vegan.

Blinding Used

Not applicable.

Intervention

Not applicable.

Statistical Analysis

- Tukey's honestly significant differences tests and chi-square tests were used to examine differences in sample characteristics across groups
- Linear and logistic regression analyses were performed with an indicator variable for each vegetarian eating pattern in the same model (omnivores were the reference group), with either BMI or weight as the outcome variable. Obesity and overweight/obesity were also treated as outcome variables in other models
- In a secondary analysis to check the association between vegetarian eating patterns and BMI, overweight and obesity, women were reclassified as actual lacto-vegetarians or actual vegans in the basis of reported dietary intakes on the FFQ.

Data Collection Summary:

Timing of Measurements

The baseline questionnaire was administered between 1987 and 1990.

Dependent Variables

BMI and weight: From self-reported height and weight.

Independent Variables

- Dietary pattern
 - Omnivore (consume all foods)
 - Semi-vegetarian (mostly lactovegetarian, sometimes consume fish or eggs)
 - Lacto-vegetarian (consume no meat, poultry, fish or eggs)
 - Vegan (consume no meat, poultry, fish, eggs or dairy products).

Control Variables

- Age
- Alcohol intake
- Education
- Marital status
- Smoking status
- Parity
- Age at first birth
- Childhood body shape

- Energy.

Description of Actual Data Sample:

- *Initial N*: 61,433
- *Attrition (final N)*: 55,459 (after applying exclusion criteria)
- *Age*: Mean (SD) age in the four dietary groups ranged from 51.1 (9.5) to 54.8 (9.5) years
- *Ethnicity*: Not reported
- *Other relevant demographics*: Self-reported dietary pattern:
 - Omnivores (N=54,257)
 - Semi-vegetarians (N=960)
 - Lacto-vegetarians (N=159)
 - Vegans (N=83)
- *Anthropometrics*: The prevalence of overweight/obesity (BMI ≥ 25 kg/m²) was:
 - 40% among omnivores
 - 29% among both semi-vegetarians and vegans
 - 25% among lacto-vegetarians
 - The four dietary groups differed significantly in BMI (P<0.005).
- *Location*: Sweden.

Summary of Results:

Linear Regression Coefficients^a Showing the Association Between Self-identified Vegetarian Eating Patterns and BMI and Weight (N=55,459)

Self-identified Vegetarian Eating Pattern ^b	Beta Coefficient for BMI in kg/m ² (standard error)	Beta Coefficient for Weight in kg ² (standard error)
Semi-vegetarian	-1.13 (0.15)**	-3.29 (0.36)*
Lacto-vegetarian	-1.07 (0.38)**	-2.74 (0.90)**
Vegan	-1.29 (0.53)*	-5.31 (1.28)**

a: adjusted for age squared, alcohol intake, education, marital status, smoking status, parity, age at first birth, childhood body shape, age and energy

b: All three eating patterns were tested in the same model with omnivores as the reference group

*P<0.05

**P<0.005

Odds Ratios^a Showing the Association Between Self-identified Vegetarian Eating Patterns and Overweight and Obesity (N=55,459)

Self-identified Vegetarian Eating Pattern ^b	Overweight or Obese: BMI ≥ 25 (95% CI)	Obese: BMI ≥ 30 (95% CI)
Semi-vegetarian	0.52 (0.43, 0.62)	0.46 (0.31, 0.66)

Lacto-vegetarian	0.54 (0.35, 0.85)	0.64 (0.34, 1.19)
Vegan	0.35 (0.18, 0.69)	0.64 (0.29, 1.40)
Lacto-vegetarian and vegan	0.47 (0.32, 0.68)	0.64 (0.29, 1.41)

a: Adjusted for age squared, alcohol intake, education, marital status, smoking status, parity, age at first birth, childhood body shape, age and energy

b: All three eating patterns were tested in the same model with omnivores as the reference group

Other Findings

- In multivariate adjusted linear regression, women who were semi-vegetarian, lacto-vegetarian or vegan, had significantly lower BMI than did omnivores. Vegans had the lowest weight compared with omnivores
- In multivariate adjusted logistic regression analyses, vegans had a significantly lower risk of overweight or obesity than did omnivores, as did lacto-vegetarians and semi vegetarians
- In a secondary analysis in lacto-vegetarians defined based on FFQ intakes, the risk of overweight or obesity remained significantly lower among actual lacto-vegetarians (OR=0.48; 95% CI: 0.30, 0.78)
- The omnivores had significantly higher energy, protein, saturated fat, and monounsaturated fat intakes and significantly lower carbohydrate and fiber intake than the three vegetarian groups. Omnivores had the highest intake of refined grains and animal products and the lowest intake of fruits and vegetables.

Author Conclusion:

Study results suggest that self-identified semi-vegetarian, lacto-vegetarian and vegan women have a lower risk of overweight and obesity than do omnivorous women.

Reviewer Comments:

Author-identified study limitations/comments:

- *Study results were not adjusted for physical activity*
- *The mean animal product intake was not actually zero in any of the self-defined vegetarian groups according to the FFQ responses. But, this consumption may not have been significant since analysis including only actual lacto-vegetarians according to the FFQ showed a similar relation with BMI and risk of overweight or obesity*
- *Estimated energy intakes were low, likely because of under-reporting that is common with the FFQ, but omitting energy from models did not appreciably change results.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	Was the research question clearly stated?	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	Was the selection of study subjects/patients free from bias?	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	Were study groups comparable?	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes

3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	Was method of handling withdrawals described?	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	Was blinding used to prevent introduction of bias?	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes

6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	Were outcomes clearly defined and the measurements valid and reliable?	???
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	???
7.5.	Was the measurement of effect at an appropriate level of precision?	???
7.6.	Were other factors accounted for (measured) that could affect outcomes?	No
7.7.	Were the measurements conducted consistently across groups?	N/A
8.	Was the statistical analysis appropriate for the study design and type of outcome indicators?	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	Are conclusions supported by results with biases and limitations taken into consideration?	Yes
9.1.	Is there a discussion of findings?	Yes

9.2.	Are biases and study limitations identified and discussed?	Yes
10.	Is bias due to study's funding or sponsorship unlikely?	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes